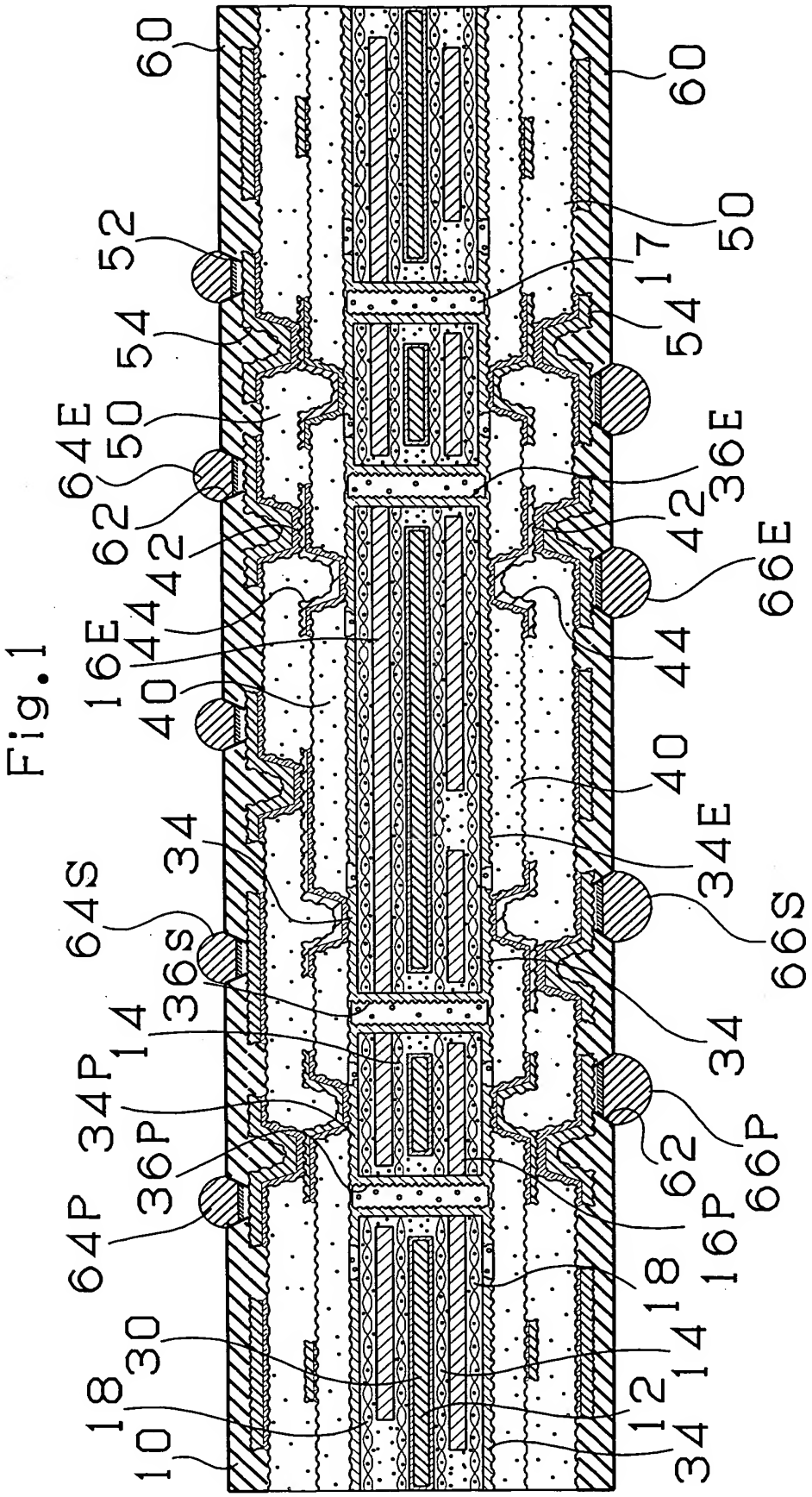
60
60
52
50
17
54
54
64E
50
36E
62
42
42
66E
16E
44
44
40
40
34E
64S
34
66S
36S
14
34
34P
36P
62
66P
64P
16P
18
30
14
18
12
10
34

Fig.1

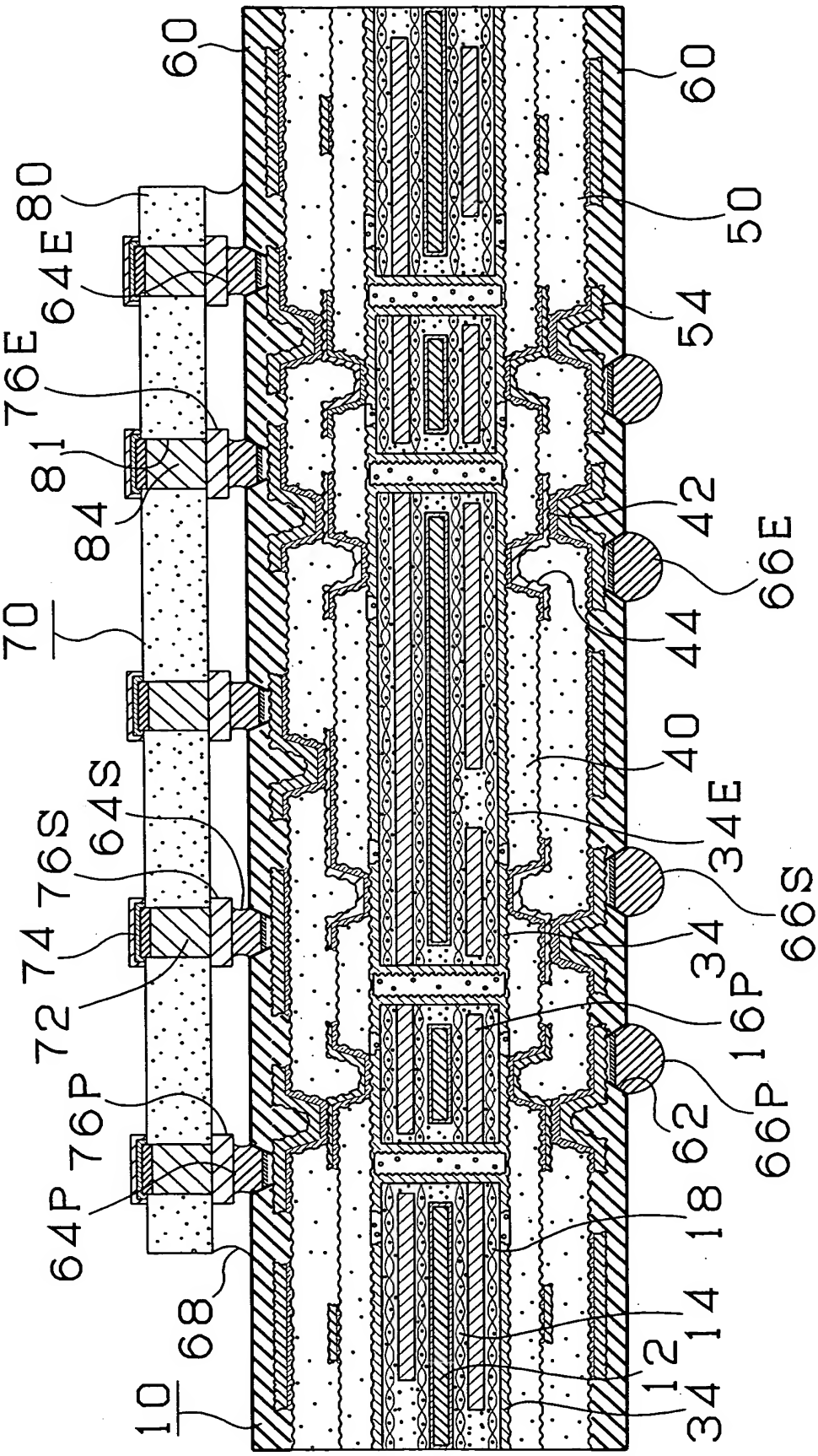
60
60
80
64E
50
54
76E
81
84
42
66E
70
44
40
64S
34E
76S
74
66S
34
72
16P
76P
66P
62
64P
18
68
14
12
10
34

Fig.2

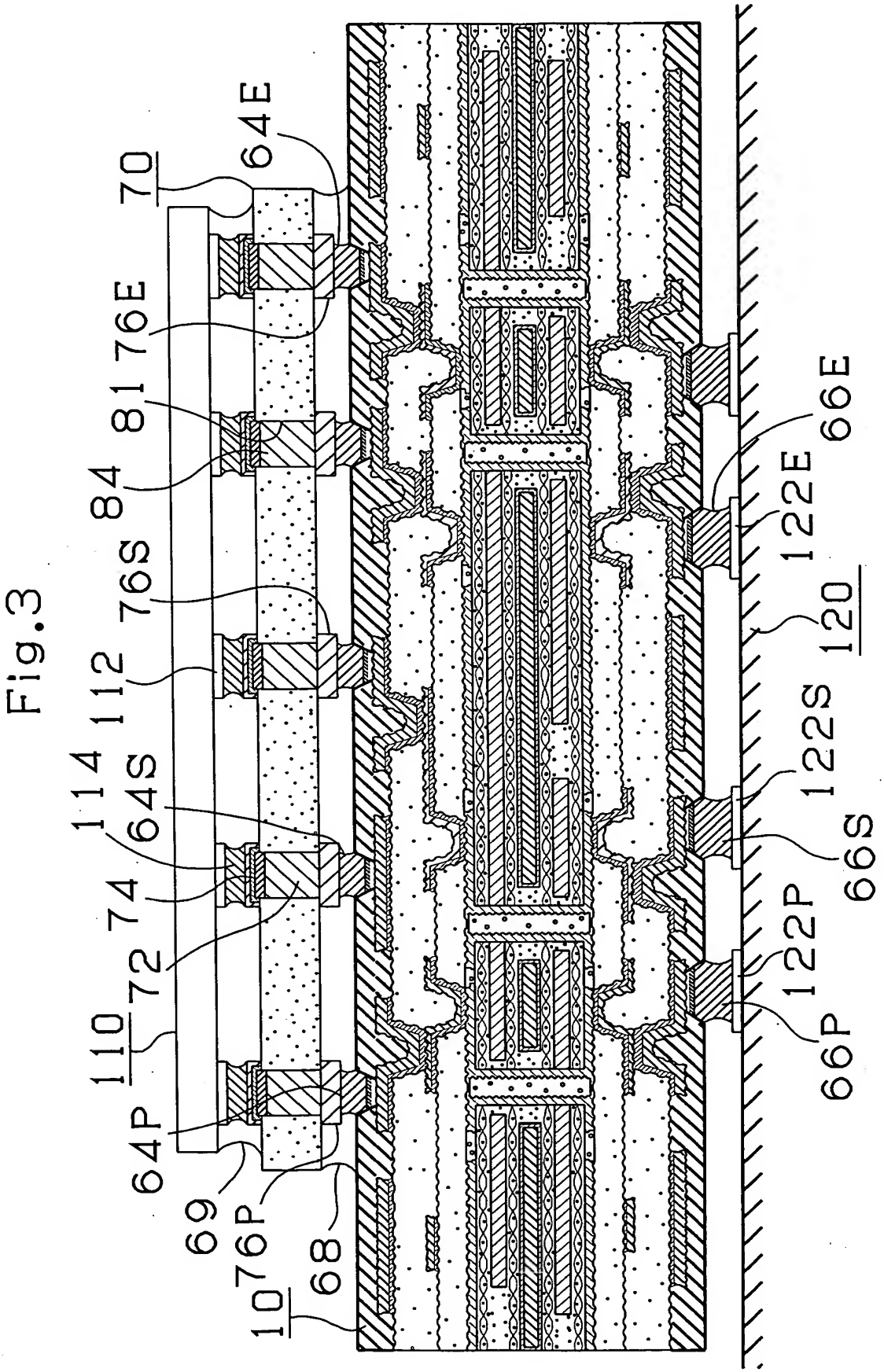
64E
70
76E
81
84
76S
112
114
64S
74
72
110
64P
69
76P
10
68
66E
122E
120
122S
66S
122P
66P

Fig.3

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Fig.4

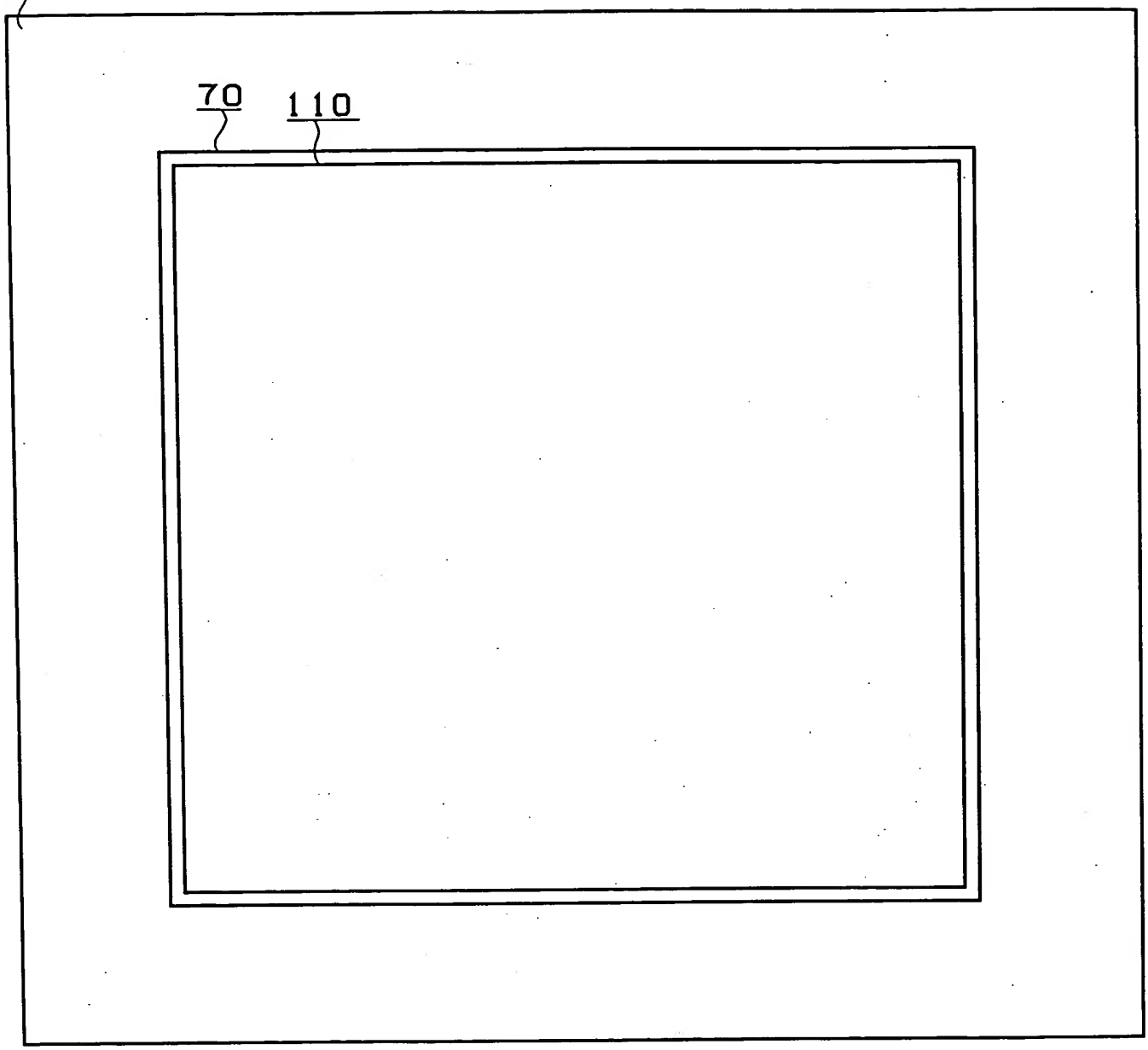

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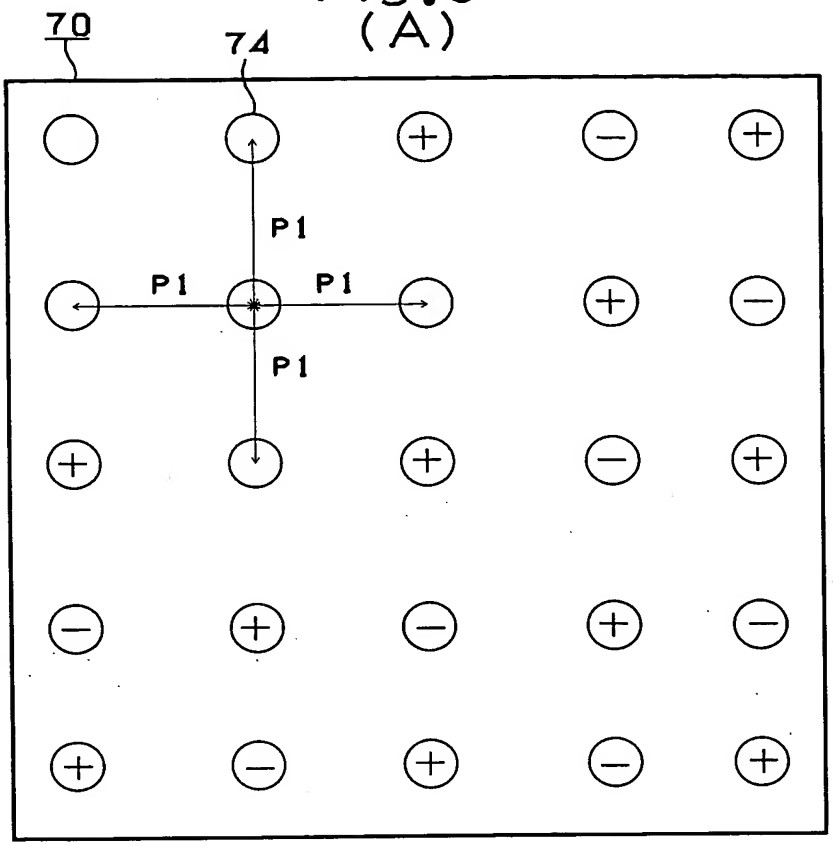
Fig.5

(A)



(B)

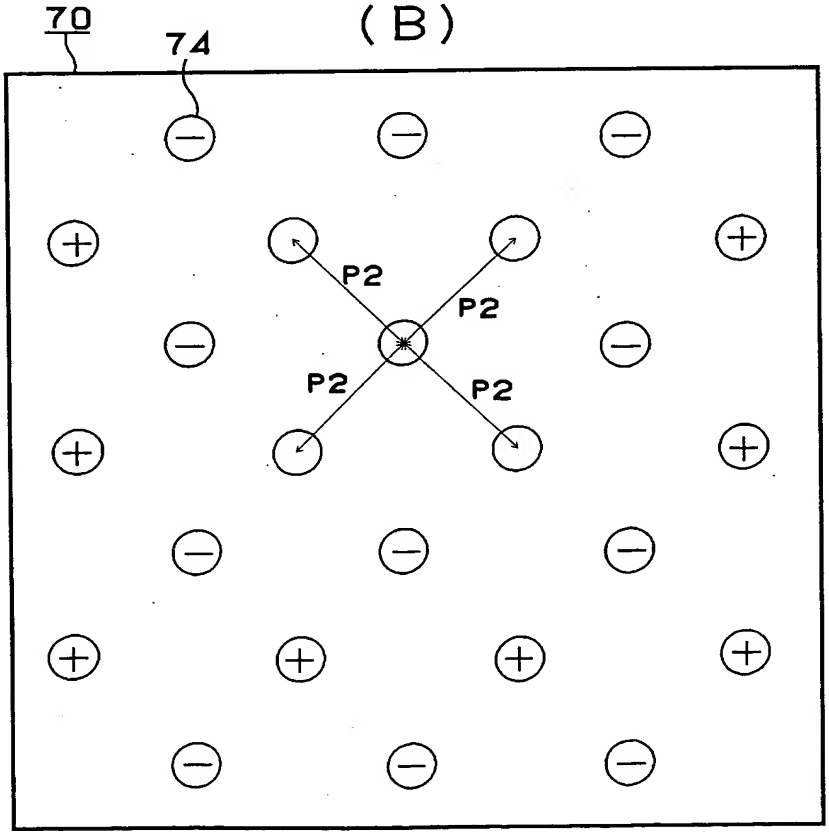


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Fig.6

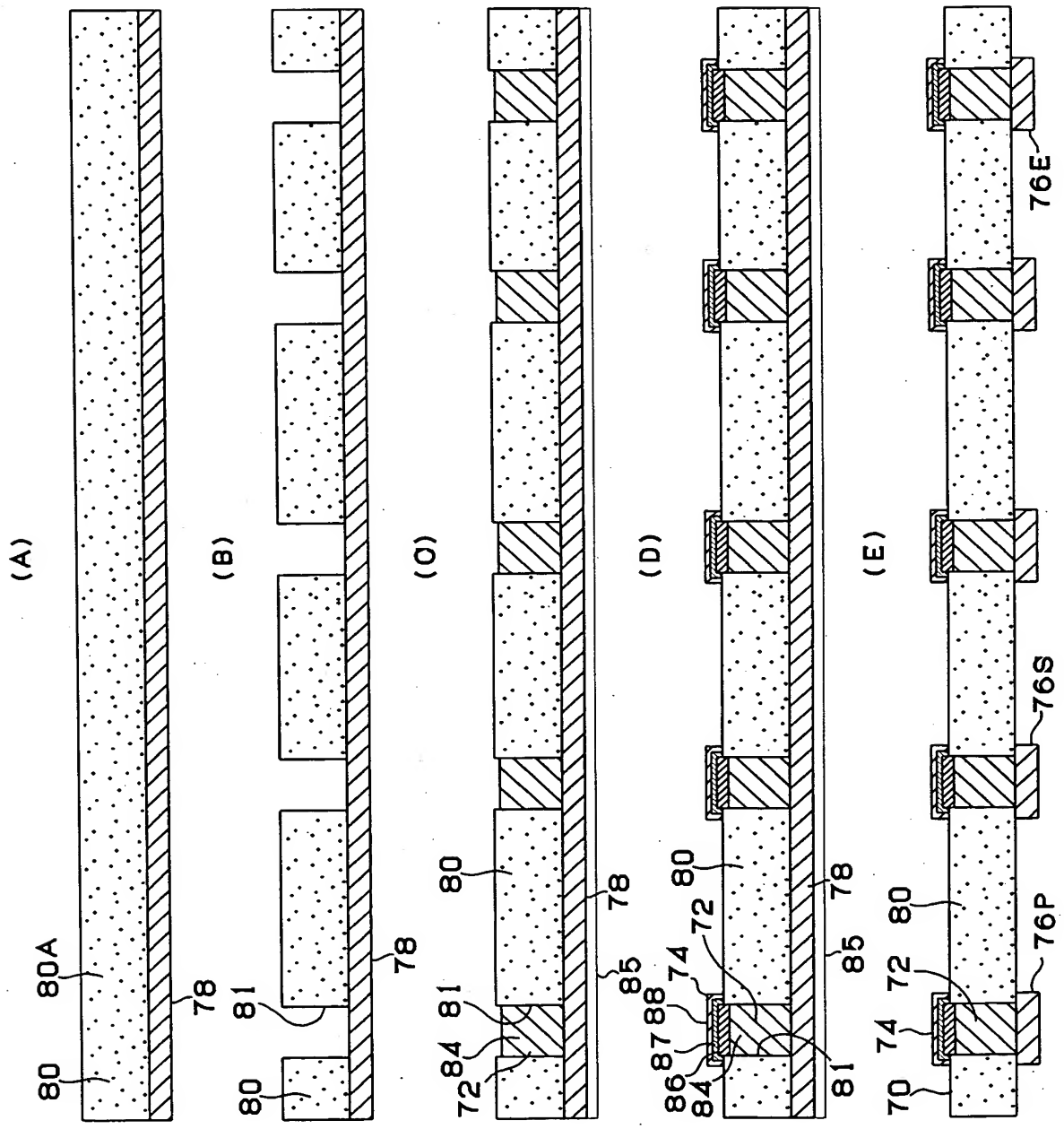

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Fig. 7

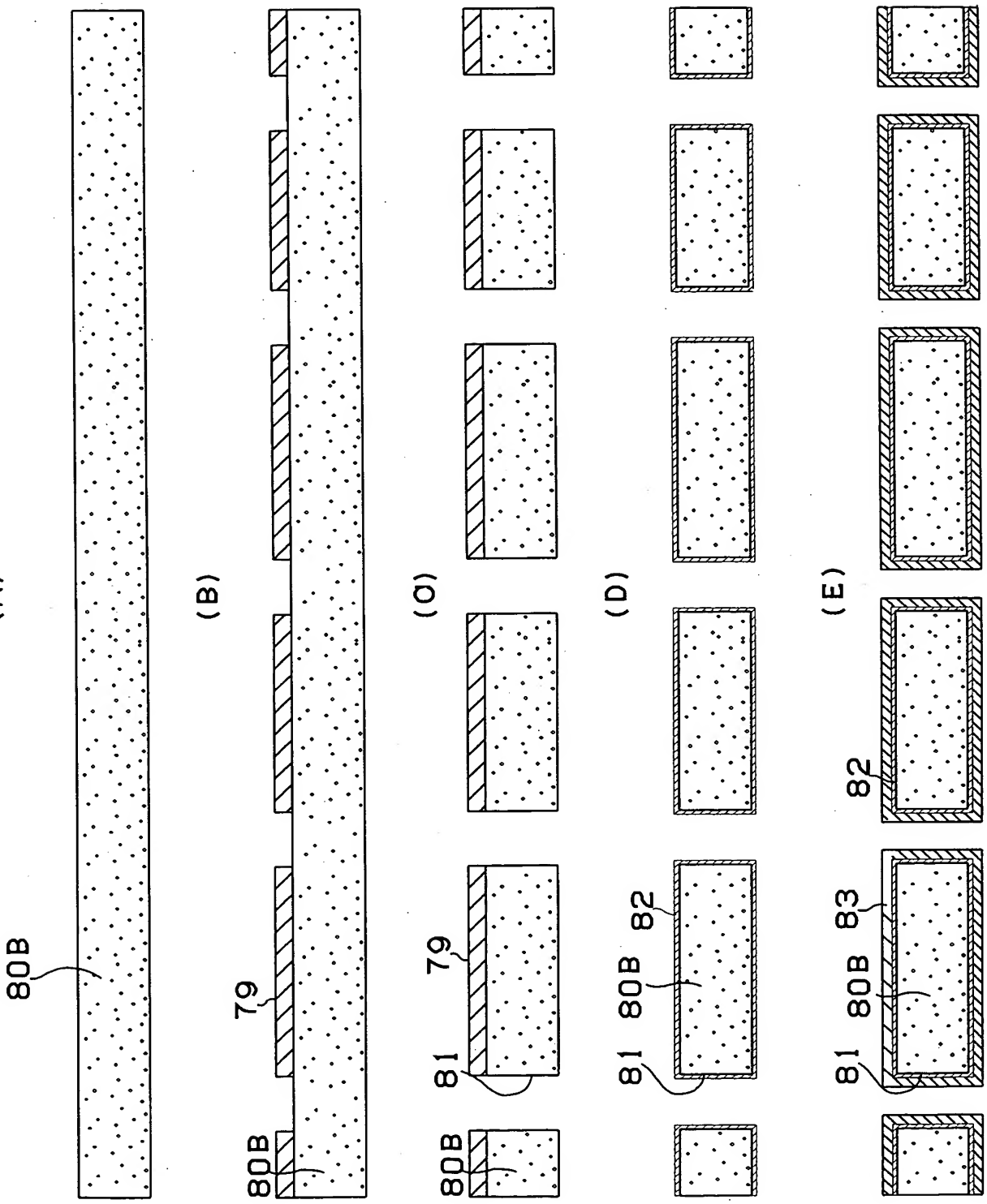

Fig.8

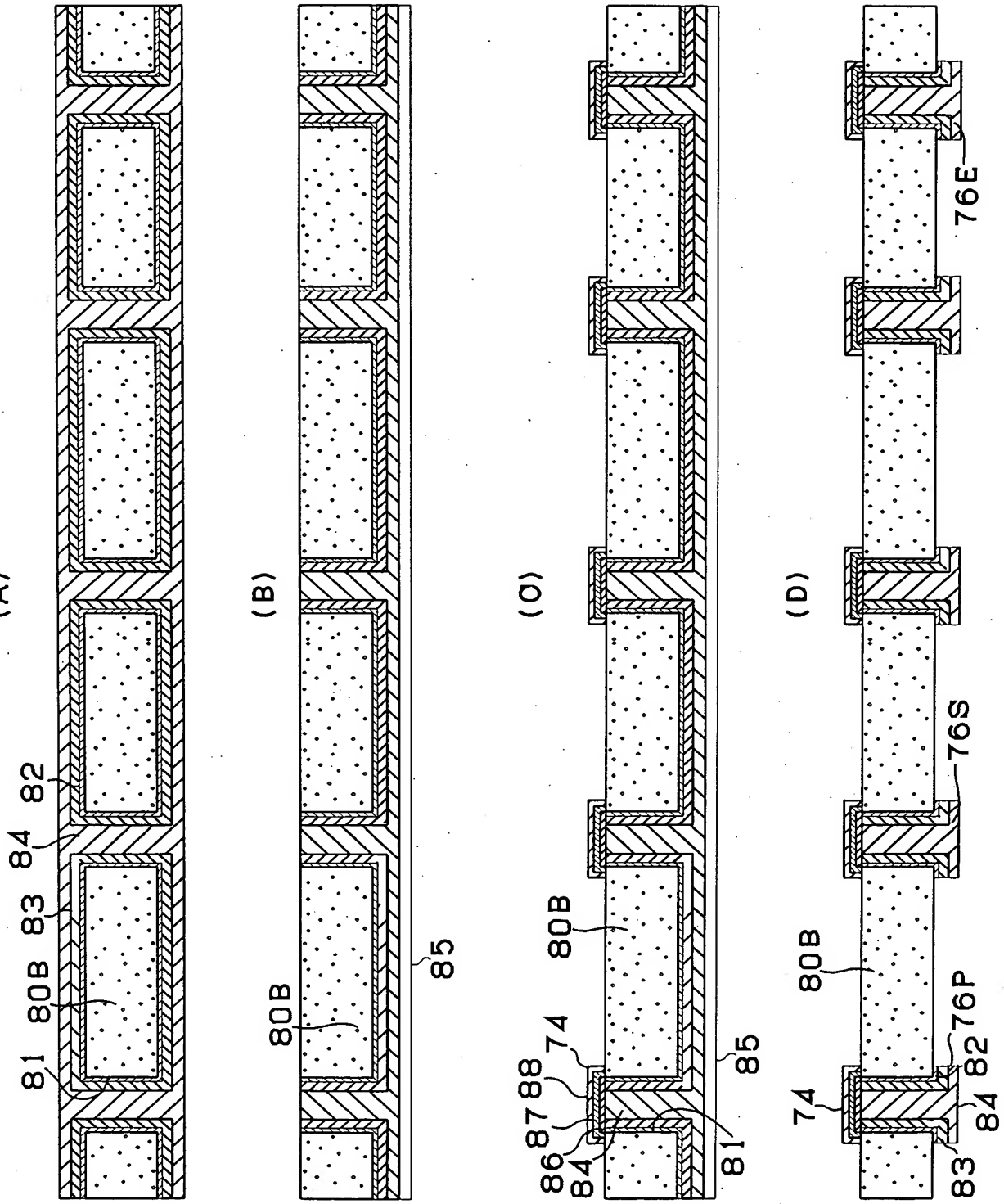
(A)
82
84
83
80B
81
(B)
80B
85
(C)
80B
74
88
87
86
84
85
81
(D)
76E
76S
80B
76P
82
74
84
83

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Fig.9

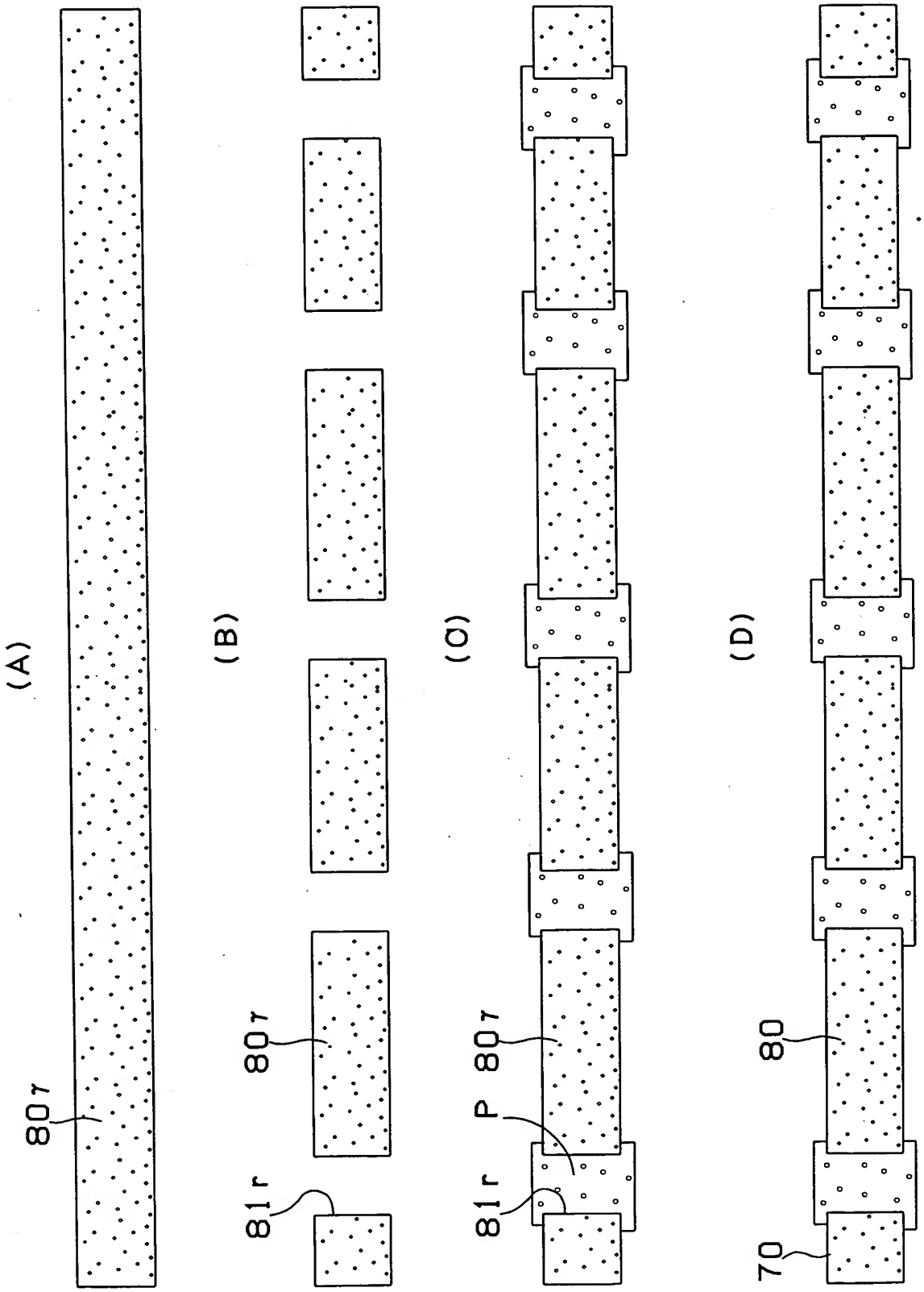

Fig.10

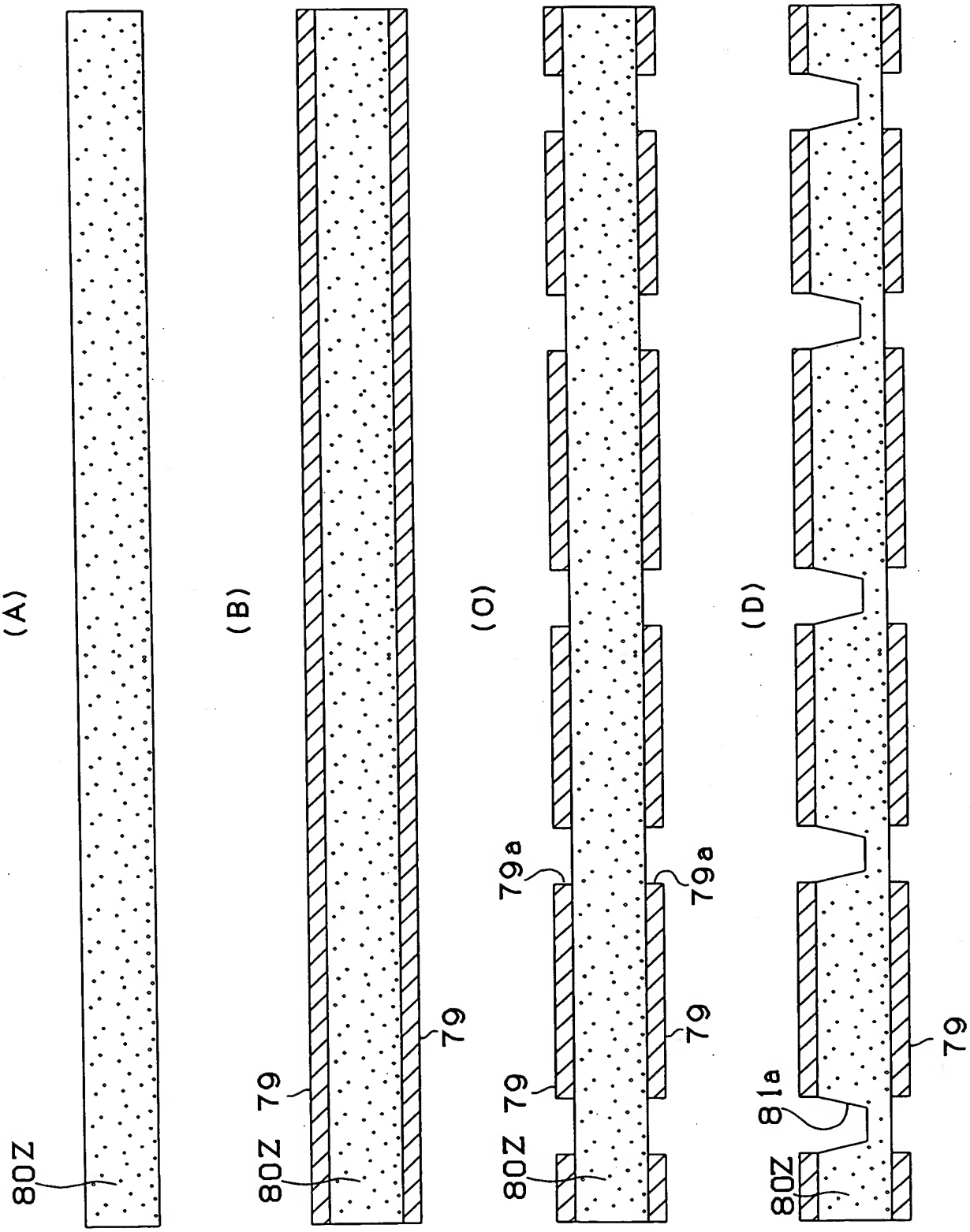

Fig.11

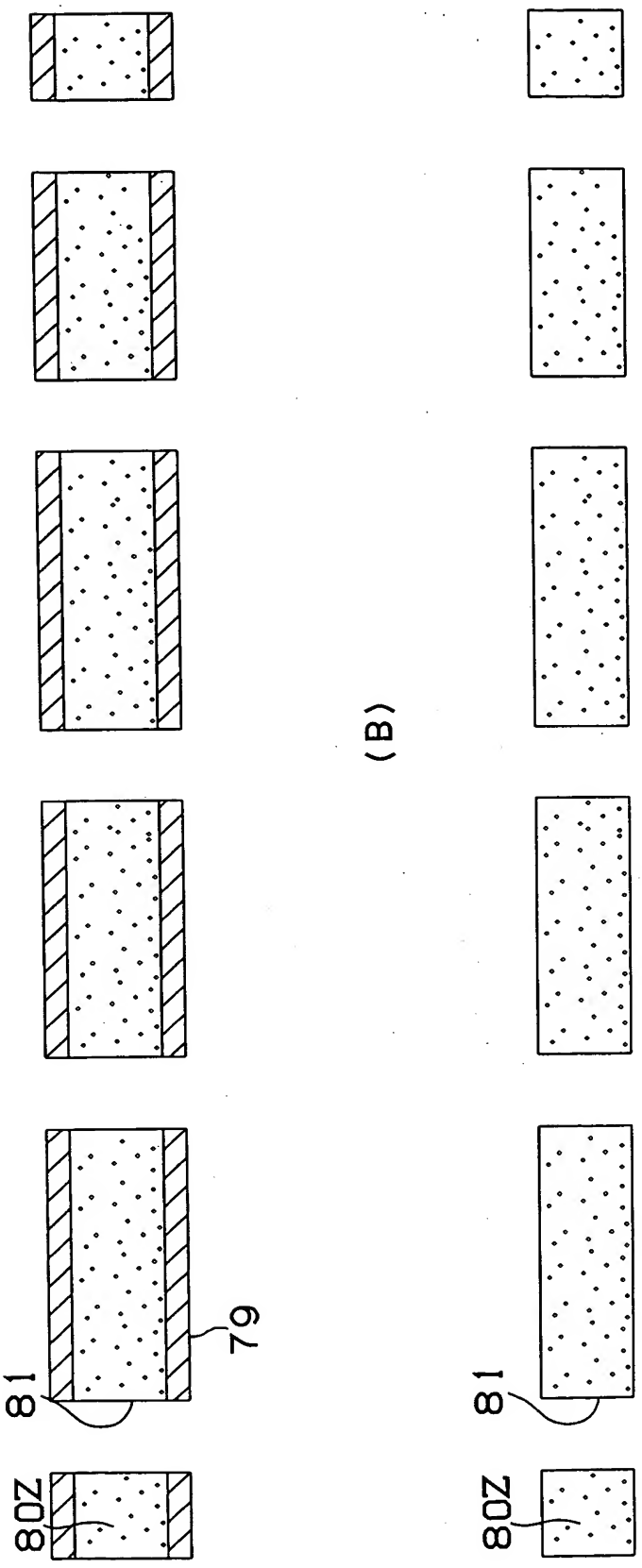

Fig. 12

	Young's modulus of insulation base material (Gpa)	Thickness of insulation base material (μmt)	Size of insulation base material (mm x mm)	Diameter of through hole formed in insulation base material (μm)			Change amount of conduction resistance after heat cycle test (%)			
				Diameter of opening in an end face	Diameter of opening in other end face	Diameter of minimum opening of through hole	After 500 cycles	After 1000 cycles	After 1500 cycles	After 2000 cycles
Embodiment1	55	50	32	125	125	125	○	×	×	×
Embodiment2	55	64	32	125	125	125	○	△	×	×
Embodiment3	55	100	32	125	125	125	○	○	×	×
Embodiment4	55	400	32	125	125	125	○	○	×	×
Embodiment5	55	1000	32	125	125	125	○	○	×	×
Embodiment6	55	1500	32	125	125	125	○	△	×	×
Embodiment7	200	50	32	125	125	125	◎	○	×	×
Embodiment8	200	64	32	125	125	125	◎	○	○	×
Embodiment9	200	100	32	125	125	125	◎	◎	◎	◎
Embodiment10	200	400	32	125	125	125	◎	◎	◎	◎
Embodiment11	200	1000	32	125	125	125	◎	◎	◎	◎
Embodiment12	200	1500	32	125	125	125	◎	◎	○	×
Embodiment13	440	50	32	125	125	125	◎	○	×	×
Embodiment14	440	64	32	125	125	125	◎	○	○	×
Embodiment15	440	100	32	125	125	125	◎	◎	◎	◎
Embodiment16	440	400	32	125	125	125	◎	◎	◎	◎
Embodiment17	440	1000	32	125	125	125	◎	◎	◎	◎
Embodiment18	440	1500	32	125	125	125	◎	◎	○	×
Embodiment19	200	100	24	125	125	125	◎	◎	◎	◎
Embodiment20	200	100	20	125	125	125	◎	○	×	×
Embodiment21	200	100	40	125	125	125	◎	○	×	×
Embodiment22	310	400	32	125	125	125	○	○	×	×
Embodiment23	310	50	32	125	125	125	◎	○	×	×
Embodiment24	310	64	32	125	125	125	◎	○	○	×

Fig. 13

	Young's modulus of insulation base material (Gpa)	Thickness of insulation base material (μmt)	Size of insulation base material (mm x mm)	Diameter of through hole formed in insulation base material (μm)			Change amount of conduction resistance after heat cycle test(%)			
				Diameter of opening in an end face	Diameter of opening in other end face	Diameter of minimum opening of through hole	After 500 cycles	After 1000 cycles	After 1500 cycles	After 2000 cycles
Embodiment25	310	100	32	125	125	125	◎	◎	◎	◎
Embodiment26	310	400	32	125	125	125	◎	◎	◎	◎
Embodiment27	310	1000	32	125	125	125	◎	◎	◎	◎
Embodiment28	310	1500	32	125	125	125	◎	◎	○	×
Embodiment29	55	50	32	125	125	125	◎	○	×	×
Embodiment30	55	64	32	125	125	125	◎	○	○	×
Embodiment31	55	100	32	125	125	125	◎	◎	◎	◎
Embodiment32	55	400	32	125	125	125	◎	◎	◎	◎
Embodiment33	55	1000	32	125	125	125	◎	◎	◎	◎
Embodiment34	55	1500	32	125	125	125	◎	◎	○	×
Embodiment35	65.5	50	32	125	125	125	◎	○	×	×
Embodiment36	65.5	64	32	125	125	125	◎	○	○	×
Embodiment37	65.5	100	32	125	125	125	◎	◎	◎	◎
Embodiment38	65.5	400	32	125	125	125	◎	◎	◎	◎
Embodiment39	65.5	1000	32	125	125	125	◎	◎	◎	◎
Embodiment40	65.5	1500	32	125	125	125	◎	◎	○	×
Embodiment41	65.5	50	32	125	125	122.5	◎	◎	◎	◎
Embodiment42	65.5	50	32	125	125	25.0	◎	◎	◎	◎
Embodiment43	65.5	50	32	125	125	25.0	◎	◎	◎	◎
Experimental Example1	200	100	32	125	125	125	○	×	×	×
Experimental Example2	200	100	32	125	125	125	◎	◎	◎	◎
Experimental Example3	200	100	32	60	60	60	◎	◎	○	×
Experimental Example4	200	100	32	60	60	60	◎	◎	○	×

Fig. 14

	Young's modulus of insulation base material (Gpa)	Thickness of insulation base material (μmt)	Size of insulation base material (mm x mm)	Diameter of through hole formed in insulation base material (μm)			Change amount of conduction resistance after heat cycle test (%)			
				Diameter of opening in an end face	Diameter of opening in other end face	Diameter of minimum opening of through hole	After 500 cycles	After 1000 cycles	After 1500 cycles	After 2000 cycles
Comparative Example1	50	100	32	125	125	125	×	×	×	×
Comparative Example2	470	100	32	125	125	125	×	×	×	×
Comparative Example3	200	45	32	125	125	125	×	×	×	×
Comparative Example4	200	1600	32	125	125	125	×	×	×	×
Comparative Example5	55	50	15	125	125	125	IC cannot be mounted on the insulation material.			
Comparative Example6	55	50	45	125	125	125	Insulation material cannot be mounted on the package substrate.			
Comparative Example7	65.5	50	32	125	125	22.7	○	×	×	×

◎ : −3% ≤ resistance change rate v 3%　　○ : −6% ≤ resistance change rate < −3% and 3% < resistance change rate ≤ 6%

△ : −10% ≤ resistance change rate < −6% and 6% < resistance change rate ≤ 10%　　X : −10% > resistance change rate and 10% < resistance change rate unacceptable if ±10% is exceeded

Resistance change rate (%) = I resistance value after heat cycle − initial value I/initial value x 100　　Thickness of package substrate: 1.0mm

Thickness of core of package substrate: 0.8mm　　External size of package substrate: 40mm x 40mm

External size of IC: 20mm x 20mm

Fig.15

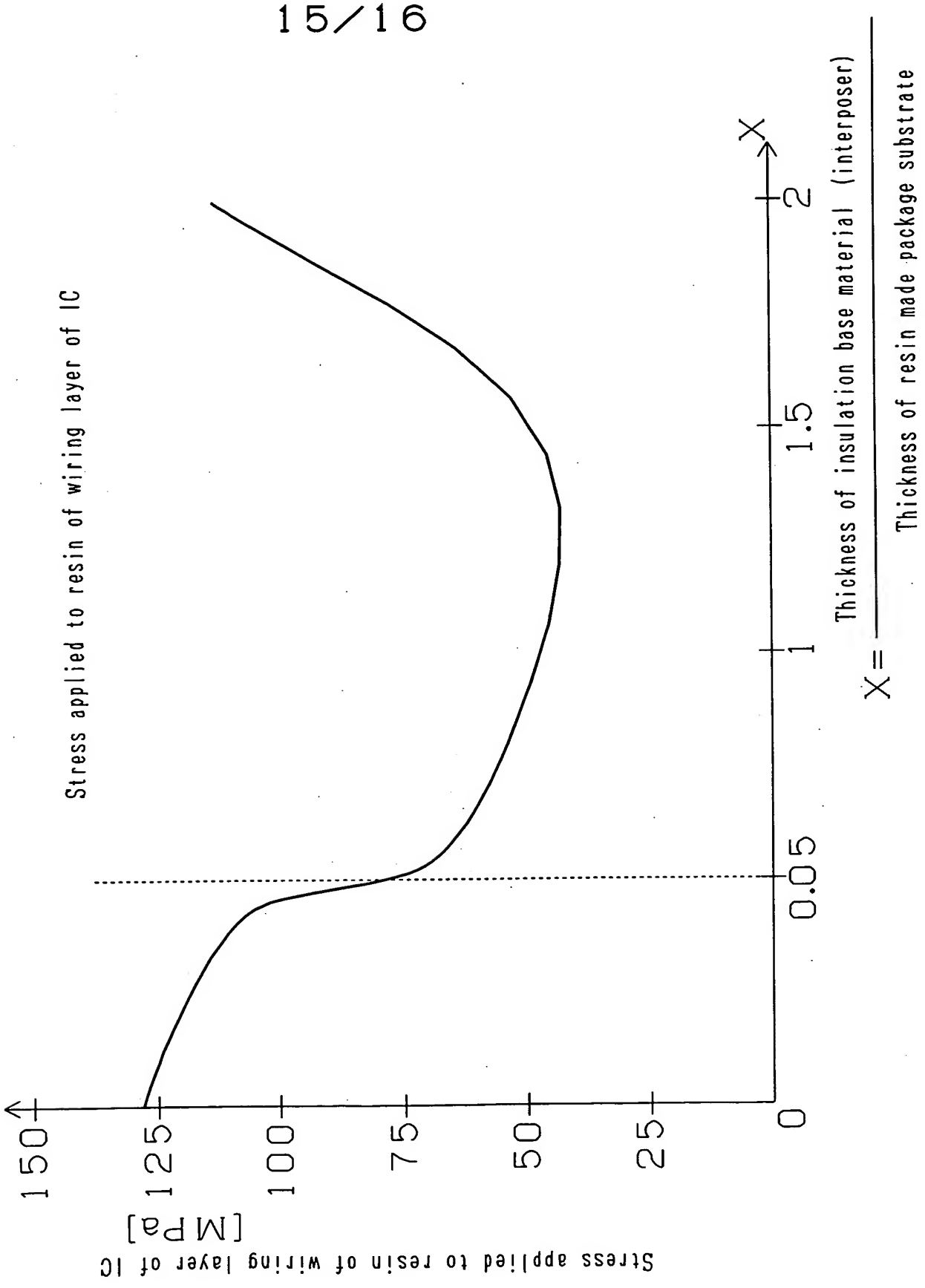
Stress applied to resin of wiring layer of IC
[MPa]
150
125
100
75
50
25
0
0.05
1
1.5
2
X
X = Thickness of insulation base material (interposer) / Thickness of resin made package substrate

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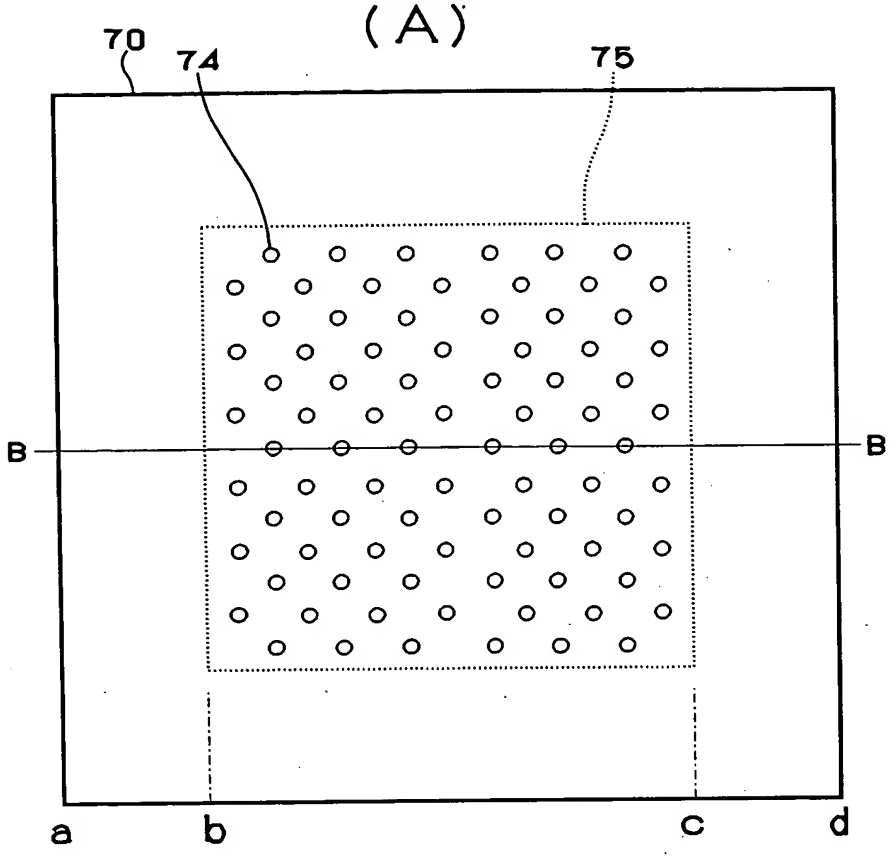
Fig.16

(A)



(B)